

## CLAIMS

We claim:

- 5     1. A method for delivering video to a set top box comprising:
- rendering a page image in a head-end based on a page  
         description written in a page description language;  
         creating a page image description frame according to said page  
         image;
- 10     sending the page image description frame to a set top box;  
         receiving the page image description frame in said set top box;  
         painting the page image description frame in a display memory  
         in said set top box;  
         receiving a video signal in said head end;
- 15     forwarding said video signal to said set top box;  
         receiving said video signal in said set top box; and  
         rendering a video image in said display memory in said set top  
         box based on the video signal.
- 20     2. The method of Claim 1 wherein the video signal received in the head  
         end is a compressed digital video stream.
3. The method of Claim 2 wherein the compressed digital video stream is  
         an MPEG stream.

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4. The method of Claim 1 wherein the page image description frame is sent to and received by the set top box as a digital image.

5. The method of Claim 1 wherein the page image description frame is sent to and received by the set top box as a video signal.

6. The method of Claim 1 wherein the video signal received in the set top box is received on a multi-state modulated radio frequency carrier.

10 7. The method of Claim 6 wherein the phase of the radio frequency carrier is varied according to the data to be conveyed thereby.

8. The method of Claim 6 wherein the amplitude of the radio frequency carrier is varied according to the data to be conveyed thereby.

15 9. The method of Claim 6 wherein the phase and amplitude of the radio frequency carrier are varied according to the data to be conveyed thereby.

20 10. The method of Claim 1 wherein the video signal received in the set top box is received on a data channel.

11. The method of Claim 1 wherein the video signal received in the set top box is a compressed digital video stream.

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12. The method of Claim 11 wherein the compressed digital video stream is an MPEG stream.

13. The method of Claim 1 wherein the step of rendering a video image in said display memory is accomplished by:

extracting a sequence of compressed digital image frames from the video signal received in the set top box; and directing the sequence of compressed digital image frames to a hardware decompressor that reconstitutes non-compressed digital image frames and writes the non-compressed digital image frames to a graphics memory.

14. The method of Claim 1 wherein the step of rendering a video image in said display memory is accomplished by:

extracting a sequence of compressed digital image frames from the video signal received in the set top box; and directing the sequence of compressed digital image frames to a software decompressor that reconstitutes non-compressed digital image frames and writes the non-compressed digital image frames to a graphics memory.

15. The method of Claim 1 further comprising the steps of:

determining in the head end the extents of the video presentation window included in the page description; sending the extents to the set top box; and

receiving the extents in the set top box.

16. The method of Claim 15 wherein the step of rendering a video image is accomplished by rendering the video image within the extents received from the head end.

17. The method of Claim 15 wherein the extents comprise the size of the video presentation window and the location of one corner of the window within the page image.

18. The method of Claim 15 wherein the extents comprise the location of a first corner of the video presentation window within the page image and the location of a second corner of the video presentation window within the page image.

19. The method of Claim 1 wherein said display memory in said set top box comprises a background plane and an overlay plane and the step of rendering a video image in said display memory is accomplished by writing video frames into said background plane and making the overlay plane transparent in the region corresponding to the video frames written in the background plane.

20. The method of Claim 1 wherein said display memory in said set top box comprises a background plane and an overlay plane and the step

of rendering a video image in said display memory is accomplished by writing video frames into the overlay plane.

21. The method of Claim 1 wherein said display memory in said set top  
5 box comprises a background plane and an overlay plane and the step  
of painting the page image description frame in said display memory is  
accomplished by writing the page image description frame into said  
background plane.

10 22. The method of Claim 1 wherein said display memory in said set top  
box comprises a background plane and an overlay plane and the step  
of painting the page image description frame in said display memory is  
accomplished by writing the page image description frame into said  
overlay plane and making a region of said overlay plane corresponding  
15 to a video presentation window transparent.

23. A set top box capable of receiving video comprising:  
page image receiver that receives a page image frame;  
page image painter that accepts the page image frame and  
20 creates an image of said frame in a display memory;  
video signal receiver that receives a video signal; and  
video image render engine that accepts the video signal and  
creates successive frame images in said display memory that  
correspond to said video signal.

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24. The set top box of Claim 23 wherein the page image receiver receives the page image frame as a digital image.

25. The set top box of Claim 23 wherein the page image receiver receives the page image frame as a video signal.

26. The set top box of Claim 23 wherein the page image receiver comprises a digital data interface.

27. The set top box of Claim 23 wherein the page image receiver comprises:

tuner for selectively receiving radio frequency modulated carriers;

multi-state demodulator that receives a multi-state modulated carrier from the tuner and demodulates said carrier into a serial data stream containing a plurality of data channels; and

program selector that extracts a specific data channel containing the page image.

28. The set top box of Claim 27 wherein the multi-state demodulator determines output data states based on the phase variance of the radio frequency modulated signals.

29. The set top box of Claim 27 wherein the multi-state demodulator determines output data states based on the amplitude variance of the radio frequency modulated signals.

5 30. The set top box of Claim 27 wherein the multi-state demodulator determines output data states based on the phase and amplitude variance of the radio frequency modulated signals.

31. The set top box of Claim 23 wherein the page image receiver comprises:

10 tuner for selectively receiving radio frequency modulated carriers;

multi-state demodulator that receives a multi-state modulated carrier from the tuner and demodulates said carrier into a serial data stream containing a plurality of video program channels;

15 and  
program selector that extracts a specific video program channel containing the page image.

20 32. The set top box of Claim 31 wherein the multi-state demodulator determines output data states based on the phase variance of the radio frequency modulated signals.

33. The set top box of Claim 31 wherein the multi-state demodulator determines output data states based on the amplitude variance of the radio frequency modulated signals.

5 34. The set top box of Claim 31 wherein the multi-state demodulator determines output data states based on the phase and amplitude variance of the radio frequency modulated signals.

35. The set top box of Claim 23 wherein the video signal receiver comprises:

10 tuner for selectively receiving radio frequency modulated carriers;

multi-state demodulator that receives a multi-state modulated carrier from the tuner and demodulates said carrier into a serial data stream containing a plurality of video program channels;

15 and  
program selector that extracts a specific video program channel containing the page image.

20 36. The set top box of Claim 35 wherein the multi-state demodulator determines output data states based on the phase variance of the radio frequency modulated signals.



37. The set top box of Claim 35 wherein the multi-state demodulator determines output data states based on the amplitude variance of the radio frequency modulated signals.

5 38. The set top box of Claim 35 wherein the multi-state demodulator determines output data states based on the phase and amplitude variance of the radio frequency modulated signals.

10 39. The set top box of Claim 23 wherein the video signal receiver receives a compressed digital video stream.

40. The set top box of Claim 39 wherein the video image render engine further comprises a hardware decompressor that:

15 accepts a sequence of compressed digital image frames from the video signal receiver;  
reconstitutes non-compressed digital image frames; and  
writes the non-compressed digital image frames to the display memory.

20 41. The set top box of Claim 39 wherein the video image render engine further comprises a software decompressor that:

accepts a sequence of compressed digital image frames from the video signal receiver;  
reconstitutes non-compressed digital image frames; and

writes the non-compressed digital image frames to the display  
memory.

42. The set top box of Claim 39 wherein the compressed digital video  
stream is an MPEG stream.

43. The set top box of Claim 23 wherein the video image render engine  
accepts display extents and creates said frame images in said display  
memory within the display extents.

44. The set top box of Claim 3 wherein the display extents comprise the  
size of the video presentation window and the location of one corner of  
the window within the page image.

45. The set top box of Claim 3 wherein the display extents comprise the  
location of a first corner of the video presentation window within the  
page image and the location of a second corner of the video  
presentation window within the page image.

46. The set top box of Claim 23 wherein said display memory comprises a  
background plane and an overlay plane and the video image render  
engine writes video frames into said background plane and makes the  
overlay plane transparent in the region corresponding to the video  
frames written in the background plane.

47. The set top box of Claim 23 wherein said display memory comprises a background plane and an overlay plane and the video image render engine writes video frames into said into the overlay plane.

5 48. The set top box of Claim 23 wherein said display memory comprises a background plane and an overlay plane and wherein the page image painter writes the page image frame into the background plane.

10 49. The set top box of Claim 23 wherein said display memory comprises a background plane and an overlay plane and wherein the page image painter writes the page image frame into the overlay plane and wherein the overlay plane is made transparent in a region corresponding to a video window.

15 50. A head end for distributing video to a set top box comprising:  
page image render unit that accepts a page description written in a page description language and creates a page image frame according to the description;  
page image transmitter that conveys the page image frame to the  
20 distribution system; and  
video routing unit that receives video signals and forwards the video signals to a distribution system

51. The head end of Claim 50 wherein the video signal received by the video  
25 routing unit comprises a compressed digital video stream.

52. The head end of Claim 51 wherein the compressed digital video stream is an MPEG stream.

5 53. The head end of Claim 50 wherein the page image transmitter is a multi-state modulator.

54. The head end of Claim 53 wherein the multi-state modulator modulates the phase of a carrier signal according to the data to be transmitted.

10 55. The head end of Claim 53 wherein the multi-state modulator modulates the amplitude of a carrier signal according to the data to be transmitted.

15 56. The head end of Claim 53 wherein the multi-state modulator modulates the amplitude and phase of a carrier signal according to the data to be transmitted.

57. A system for delivering video to a set top box comprising:

distribution system;

20 head end comprising:

page image render unit that accepts a page description written in a page description language and creates a page image frame according to the description;

25 page image transmitter that conveys the page image frame to the distribution system; and

video routing unit that receives video signals and forwards the  
video signal to the distribution system; and  
set top box comprising:

page image receiver that receives a page image frame;  
page image painter that accepts the page image frame and  
creates an image of said frame in a display memory;  
video signal receiver that receives a video signal; and  
video image render engine that accepts the video signal and  
creates successive frame images in said display memory  
that correspond to said video signal.

58. The system of Claim 57 wherein the video signal received by the video  
routing unit comprises a compressed digital video stream.

59. The system of Claim 58 wherein the compressed digital video stream is an  
MPEG stream.

60. The system of Claim 57 wherein the page image transmitter is a multi-  
state modulator.

61. The system of Claim 60 wherein the multi-state modulator modulates the  
phase of a carrier signal according to the data to be transmitted.

62. The system of Claim 60 wherein the multi-state modulator modulates the  
amplitude of a carrier signal according to the data to be transmitted.

63. The system of Claim 60 wherein the multi-state modulator modulates the amplitude and phase of a carrier signal according to the data to be transmitted.

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64. The system of Claim 57 wherein the page image receiver receives the page image frame as a digital image.

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65. The system of Claim 57 wherein the page image receiver receives the page image frame as a video signal.

66. The system of Claim 57 wherein the page image receiver comprises a digital data interface.

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67. The system of Claim 57 wherein the page image receiver comprises:

tuner for selectively receiving radio frequency modulated carriers;

multi-state demodulator that receives a multi-state modulated carrier from the tuner and demodulates said carrier into a serial

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data stream containing a plurality of data channels; and  
program selector that extracts a specific data channel containing the page image.



73.The system of Claim 71 wherein the multi-state demodulator determines output data states based on the amplitude variance of the radio frequency modulated signals.

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74.The system of Claim 71 wherein the multi-state demodulator determines output data states based on the phase and amplitude variance of the radio frequency modulated signals.

10 75.The system of Claim 57 wherein the video signal receiver comprises:  
tuner for selectively receiving radio frequency modulated carriers;  
multi-state demodulator that receives a multi-state modulated carrier from the tuner and demodulates said carrier into a serial data stream containing a plurality of video program channels;  
15 and  
program selector that extracts a specific video program channel containing the page image.

20 76.The system of Claim 75 wherein the multi-state demodulator determines output data states based on the phase variance of the radio frequency modulated signals.



77.The system of Claim 75 wherein the multi-state demodulator determines output data states based on the amplitude variance of the radio frequency modulated signals.

5 78.The system of Claim 75 wherein the multi-state demodulator determines output data states based on the phase and amplitude variance of the radio frequency modulated signals.

10 79.The system of Claim 57 wherein the video signal receiver receives a compressed digital video stream.

80.The system of Claim 79 wherein the video image render engine further comprises a hardware decompressor that:

15 accepts a sequence of compressed digital image frames from the video signal receiver;  
reconstitutes non-compressed digital image frames; and  
writes the non-compressed digital image frames to the display memory.

20 81.The system of Claim 79 wherein the video image render engine further comprises a software decompressor that:

accepts a sequence of compressed digital image frames from the video signal receiver;  
reconstitutes non-compressed digital image frames; and

writes the non-compressed digital image frames to the display memory.

82. The system of Claim 79 wherein the compressed digital video stream is an MPEG stream.

83. The system of Claim 57 wherein the video image render engine accepts display extents and creates said frame images in said display memory within the display extents.

84. The system of Claim 83 wherein the display extents comprise the size of the video presentation window and the location of one corner of the window within the page image.

85. The system of Claim 83 wherein the display extents comprise the location of a first corner of the video presentation window within the page image and the location of a second corner of the video presentation window within the page image.

86. The system of Claim 57 wherein said display memory comprises a background plane and an overlay plane and the video image render engine writes video frames into said background plane and makes the overlay plane transparent in the region corresponding to the video frames written in the background plane.

87.The system of Claim 57 wherein said display memory comprises a background plane and an overlay plane and the video image render engine writes video frames into said into the overlay plane.

5 88.The system of Claim 57 wherein said display memory comprises a background plane and an overlay plane and wherein the page image painter writes the page image frame into the background plane.

10 89.The system of Claim 57 wherein said display memory comprises a background plane and an overlay plane and wherein the page image painter writes the page image frame into the overlay plane and wherein the overlay plane is made transparent in a region corresponding to a video window.

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